SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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THE STUDY OF GEOLOGY—ITS SOCIAL VALUE AND INDUSTRIAL IMPORTANCE.

Address by Mr. Hyde Clarke, C.E., to the "Geologist Association."

At the outset of an institution of this nature it is desirable, with a view to its successful progress, that it should hold out advantages to the individual members, and the promise of public good. The organisation we have formed as the Geologists' Association will afford to each student of the science great and invaluable assistance: for by instituting a co-operation among working geologists, each will be directed and aided in his pursuits, and many new followers of the study be enlisted. It is not every one who has the time or the means disposable to enable him to make geology the aim and occupation of a life, as Buckland, Murchison, and Lyell have done. We cannot, many of us, undertake distant explorations, accumulate costly musuems, or write and publish volumes; but there is a large body of men, and of women too, who can give themselves much satisfaction, and be the means of doing considerable good. The materials for geological collections are much more accessible than those of any other home musuem. The mammalia are costly to preserve dead, as they are to maintain alive, and thus they can only afford a luxury for a princely Earl of Derby. Birds are attractive to the collector, but there is much trouble in the collection. The art of preserving the skins must be learned and practised: local specimens are few, but glass cases accumulate. Thus they do scarcely afford a homely pursuit, though some zealous weavers have fair collections. Insects afford to the same class, as to others of the working classes, and to wealthier students, a limited scope for their collection and preservation; and they come nearer to our collections in their facilities than perhaps any other, but we must claim the superiority for our own. An herbarium may be formed from the flora of one's neighbourhood; but inasmuch as the plants can be readily seen alive, and are familiar to those interested in the pursuit, the formation of an herbarium is not self-satisfying. Coins and antiquities are only found by chance, and must, under all ordinary circumstances, be purchased on the faith of a dealer, and with all the risk of spuriousness. Mr. Toulmin Smith, in his discourse, has referred to the blunders and frauds of dealers in fossils, but these are as nothing compared with what occurs to the purchasers of archæological objects. Every house that is pulled down, and every foundation that is dug in the City, is attended by ingenious navvies and bricklayers' labourers, who are ready to sell to the incautious spectators and neighbours true and spurious coins, swords, and pottery; and many a man gives a sixpence for a Roman coin which neither in olden times nor now was ever worth half a farthing; but he thinks it has been found under his own eyes. Some of these working class antiquaries have very large transactions with the dealers in antiquites and the fabricators of them. At this moment, notwithstanding a law suit between a dealer and the proprietor of the *Athenæum* the archæological world is divided as to the value of a find of what are called pilgrims' medals, or tokens.

Coin collecting seldom gets very far, but still, if indulged in at a considerable expense, the owner has always value for his money; and there is one comfort, that the coins do not eat and drink, nor require much expense for their entertainment. It is, however, a vicarious pursuit, dependent on the good faith of others; but in most parts of these islands a man may gather minerals or fossils for himself, and have the satisfaction of finding his own materials, and that is a great one. These he can, with a little time and trouble, dress up, and bring to a suitable condition for preservation and display; and as the objects are durable, but little expense need be encountered by the humble collector. In many neighbourhoods a large number of minerals and fossils may be gathered, and then there is the resource of a ramble into another formation; for, on account of the great complexity of our geological arrangements, we have in these islands abundant variety, far different from some of the great basins or plains of Russia and of India, where there are large districts with superficial diluvial or alluvial formations, without any intruded rock. Thus there is a great encouragement to the pursuit of geology here to what there is in many countries even near to us. Take, for instance, the low parts of Flanders, the like country in Holland, or the northern regions of Germany, where there is little for the humble student to explore on his own account. He may witness the gigantic operations of creative action, but he may learn them better at second hand from others than on the spot, as in his narrow sphere he wants the means of comparison, unless he be near the sea, when he may observe the likeness or identity of its shores and of the adjoining dry land; but he has to witness the accumulated results of thousands of years, or the influence of phenomena long lost, with only a brick, as it were, to judge of a vast edifice, the means by which it was brought together, its form, its appliances, and the beauties of its construction.

By means of this Geologists' Association the home student will receive constant encouragement, for he can learn when he has remarkable specimens beyond the common means of reference, and by the increase of members, and the development of operations, he will have made accessible to him the whole of the regions of these islands, fertile in the records of every formation, from the primeval to the last depositions of sea or river silt. Thus he will not deem himself doomed to the possession of manifold copies of a few specimens, because he will know of working brethren in other districts, by exchange with whom, to make his fewer resources comparative wealth, and from the moment of collection to give him assurance that it depends on his own industry and energy alone to become the owner of as large a museum as his house will hold, and to be able to display to his neighbours the records of other districts, and afford practical materials for the study of the science to all who desire to extend their knowledge beyond books to the actual things themselves, which are the true coins and medals of this world's great history. This is a source of enjoyment which cannot fail to prove gratifying to any right-minded man, and the enjoyment of it will induce many to enrol themselves in this Association.

Such pursuits, too, have this moral advantage, that they are social, that they can be innocently engaged in by the young, and, what is of great importance, that our wives, daughters, and sisters may share with us the interest, the pleasure, and the honour. And you will remember how great a part women, quietly labouring, have had in the extension of our knowledge of the fossils of our islands. Mr. James De Carle Sowerby, whose eminence as a labourer in fossil conchology is known to you better, perhaps, than his great acquirements in every branch of natural science, was kind enough to write me this memorandum as to our female geologists:—

"I know one lady now living who can be named independently as a geologist—Lady Murchison—who was at one time very zealous. Lady Lyell works at geology also to assist Sir Charles. Miss Benett, when living, stood very high. In Wiltshire she made a very extensive collection, and published a catalogue of them; she worked hard with her hammer. These ladies had long purses, and made good use of them. The late Marchioness of Hastings sought for fossils in the tertiary strata of Hampshire, and made some important discoveries of bones in the fresh water beds. Mrs. Cobbold, of Ipswich, collected the Cray fossils of Suffolk. Miss Beminster collected the fossils of Hordwell, both shells and saurians. In the same field was Mary Anning, a guide, who picked out very fine things for sale, and made herself fully acquainted with them. But these ladies have long passed away. There are, doubtless, others who are wearing their mantles, and will probably inherit their crowns, but I have not the pleasure to know them, having retired from their domains.—J. De C. Sowerby."

The founders of this Association, mindful of these facts, have provided for the admission of women; and it is to be hoped that many beyond those elected this night will be hereafter enrolled in our list, and labour in this new sphere of usefulness.

Thus we may look forward with confidence to the constitution of a society which will count hundreds of members, dispersed throughout the country, and with greater means of doing good, generally and individually, in proportion to the increasing strength of the Institution: hence, pledged to us, our members will cease to look to the mere personal benefit of individual enjoyment, or the consideration of how many shillings' worth they get for a ten shilling subscription, but will feel that they have an interest in geological science for its own sake, and will feel an anxiety to promote it. Some whose circumstances will permit will give a more special attention to geological studies; and it is to be hoped that this Association will be the means of encouraging and rearing up many whom generations to come will acknowledge as true geologists. Some, whose means or pursuits allow them less choice, will devote themselves to promoting an interest in the science in their own district, and increasing the numbers of their fellow-workers. Some will take up the investigation of a local formation, or particular class of fossils, and earn for themselves distinction in our annals. Some may become famous by fortuitous discoveries, and their success encourage the general mass to greater efforts. Many a mining captain and many a working miner will, it is to be hoped, be enrolled among us, and be induced to take greater advantage of the rare opportunity of underground exploration. As the bent for other studies incline, so we shall have members who apply for our purposes a knowledge of chemistry and physiology, or devote themselves to microscopic examination. Thus in many ways the bounds of knowledge will be enlarged, and credit will be reflected on this Association.

There will, however, be the opportunity for combined exertion, in which the organisation of a body like this will be found particularly valuable. Except in Cornwall, there is no local Geological Society widely distrbuted in England, and there are few local societies, nor has the Wernerian Society compassed the whole of Scotland, or the Royal Irish Academy enlisted every working geologist in Ireland. To all the local societies this Association will give increased energy, while it will fill up the blanks between their territories. As the number of our members in each county increases, virtually a branch'association will exist for each county; and with a further increase in each district, we shall have in each a local committee, known to each other, working together, and conversant with the features and resources of the neighbourhood. The chief obstacle to local geological societies is that few can afford to pay a two guinea subscription, and that nothing can be done with a half-guinea subscription; and thus their extension can never be general, and for the main work of the country they must be dependent on this Association, a fact of which it is to be hoped we shall be mindful, and which is a great encouragement to our exertions. Naturalists' clubs may combine a few zealous workers, but they cannot afford funds for the publication of transactions, or communication of information.

It is a necessary consequence of our Institution that we shall have a local organisation as well as a general one: we shall have our local secretaries, and in some places our local committees; and wherever a special investigation is to be carried on, we shall have the machinery to secure it. Whoever considers the formation of architectural and archæological societies throughout the country for the purpose of local observation, will see that we have likewise a wide scope for investigation. They have merely a few buildings to examine, and a few chance explorations, to gratify them, but we have the whole surface of the country open to us, and the fruitful contents of its strata. Thus our mission is greater, and we must endeavour to fulfil it.

It will be seen what assistance our local members will afford to the Geogical Section of the British Association at its various places of meeting, and what opportunities they will have of carrying out any local enquiry. My object on the present evening is to show that our organisation permits us to carry out continuously and systematically that important end of geological labours—the study of the geology of our own country. The collector of fossils may gratify himself, but there his labours centre and end; but he who adds one new fact to our knowledge of the geological formation of this country and its mineral resources renders a service to the common cause, and becomes a national benefactor, by the same title as he who grows two blades of grass where one grew before: he adds to our stock of knowledge, and thereby to our national wealth, for on the soil of this country are we greatly dependent for the growth of vegetable food, for the nurture of cattle, for the supply of water and water-power, for the provision of manures, for fuel, for the materials of building, for our metals, and the physical instruments of our greatness as a nation.

Let us briefly consider the effect of an individual discovery in this department of science. Take the anthracites, for instance; their application for steam fuel has caused general researches to be made to ascertain our supplies of this fuel. The great discovery of the blackband ironstone, followed up by the explorer, has created in Scotland a vast seat of the iron manufacture, as the discovery of other stores of the metal have made Cleveland and Northamptonshire new seats of the same industry. The Torbane fuel, found useful for gas, has given a stimulus to the application of the like formation to industrial purposes. The adaptation of coprolites for agricultural purposes has made the working of these fossils a matter of importance. One word or one experiment has been the origin of branches of industry which employ their tens of thousands, upon minerals which once were lying waste and idle. In the cases here referred to districts unoccupied were made the seats of manufacture, or new resources were given for universal employment to populations ready to engage in them. Year by year the application of some mineral substance is discovered, and it comes into request. Thus the successful introduction of aluminium as an article of commerce is attracting attention to the sources of supply. The metal is almost universally diffused, but the best rocks or soils for metallurgic purposes have yet to be ascertained, and it is strange that as yet the aluminium workers of Europe are chiefly supplied from a local deposit of kryolite in Greenland, with one chief material for their operations.

That great national establishment of the Geological Survey is earnestly and perseveringly carrying on its labours, and mapping out these islands; but it has to follow in the wake of the Topographical Survey, of which England is still incomplete, and of Scotland little is mapped out. This great work, when carried out, will make known to us the broad features of the geological formations of the country on the scale of the Ordnance Survey, of 1 inch to the mile; and many details will be afforded by the valuable reports on remarkable localities published in the annals of the Survey. This labour is not, however, at an end, and we can assist in it, but we can likewise assist the department as to those portions of the Survey already completed.

Let us take the case of a mine which has been sunk in Cornwall or South Wales since the Geological Map of the district had been published. This may afford us most important evidence as to the extent of strata or of a fault, their constituents, and the lodes that run through them. Even a fresh artesian well driven through the stata of the London basin is sure to give some new facts as to the thickness of the strata, and may illustrate some phenomenon of importance in relation to the geology of the locality. Wherever by mines, wells, or quarries, inlets are made to the inferior formations, we get at new and valuable facts—valuable still if the observations confirm our deductions from superficial indications, while the discovery of new fossils in a district has a material influence on its geological classification; for as we get a wider knowledge of the phenomena of the earth, so by the comparison of fossils we are better able to determine the relations between the members of a series. A formation found to be fossiliferous, which was supposed to be non-fossiliferous, or one found on further research to present fossils in different proportion from that assumed on hasty or partial examination, will obtain a different place in our maps and our records.

The Ordnance Survey, large as is the space its sheets occupy when joined together, is still too small for us when we come to examine local phenomena, when even in one field many soils are to be found, and where the substratum, which is of importance, may be found at various depths, of uncertain thickness, and of modified conditions. In the mountain regions of Wales and Scotland, which have not been subjected to minute explorations, many facts have to be gleaned by further enquiry in the process of time, and this we find to be the case even with regard to Cornwall, where the energy of men of science, and the ardour of the speculators, have caused constant surveys to be carried on; yet who will dare to say what the depths of Cornwall may still tell us, or what further resources may be made available from the heaps of attle refuse on the surface, and from the unexplored regions below.

A very striking proof of the manner in which geological facts are still gathered is afforded by an announcement at the last Manchester Geological Society, by Mr. E. W. Binney, the President, that within the foregoing fortnight he had been surprised to find lias in the neighbourhood of Carlisle, as geologists had lost sight of it between Cheshire and the Clyde. What he had seen probably extended over an area of 10 or 12 square miles, between the Maryport Railway and the Port Carlisle Railway, and was covered with a great deal of drift.

In order to promote these enquiries, and to obtain a better knowledge of the subject, this Association has the power to do much, and, fortunately, without imposing any burthen upon its pecuniary resources, for our subscription is small—enough to work out our plan, to provide rooms, offices, the expenses of correspondence, a library, a museum, and printing; still it may here be observed that our resources will prove larger than the mere amount of the subscriptions. Take, for instance, our museum; its chief value will not depend on our expenditure, but on contributions; so, too, our library of books and maps will be chiefly provided by donations and bequests, leaving us to find the room, the librarian, the binding, and current expenses. From time to time subscriptions will be raised among the wealthier members for special purposes; by and by we shall be able to fund our life subscriptions, and many years will not have elapsed before we have a considerable property, and are in a position to ensure the permanent existence of the institution. The object here proposed, so far from requiring funds from us, will bring us resources by inducing many public-spirited men to become members of the Association. What we want to effect our purpose is organisation, and the free and willing labour of all our members.

The work must be one of time, slowly, steadily, and systematically carried on, because it is to be continuous and enduring in its fruits. It will require the services of a committee of the Association to set it in action, so that local committees, or sections of the members, may be arranged, and that the mode of working may be properly devised. Where we have only a few members in a district our endeavours must be limited to a few useful ends, but as our members increase we may undertake more minute enquiries. Each local section should have a secretary for this department of research, and perhaps a functionary in the nature of the *rapporteur* of the French academies, already known in our scientific circles as a reporter, who will have to draw up the yearly report of the labors of his colleagues.

The first duty of a section is an easy one, because the materials are in the libraries of the members, and that is to report on the state of the Geological Survey and records of their district. Their next task is to consider what deficiencies have to be supplied, and what objects of enquiry are open to them. In some districts they will find but little is needed, except to record new discoveries as they arise, but in most they will find that there is a wide field for minute delineation of the geological features of which the Ordnance maps only give the broad outlines, in some cases compressing the history of thousands of years, and the details of several strata within one coloured band. As greater strength is obtained, and the zeal of our members is encouraged, we shall obtain an extent of record not yet reached by any Government or in any country; for it is to be hoped the time will come when each superficial indication will be portrayed, and the township and parish maps of the Tithe Commutation Survey be made available for the registration of the geological features.

Thus, as has been shown by the careful collection of facts, we shall lay a sound basis for generalisation; we shall be able to authenticate or correct the rough outlines of our geological maps, and we shall give the man of science sound data on which to base the minutest enquiries. These maps will, like those of the Geological Survey, be accompanied by detailed reports of each district, giving its geological history and condition, and affording a basis for the aggregation of new facts. Thus we shall have in time authentic geological reports of each township and of each superficial formation.

The yearly reports of the sections and committees will furnish this Association with a mass of facts invaluable to geological science and of national importance, assisting and extending the Government Survey, and creating for this Association a solid reputation. Thus we shall become one of the recognised scientific bodies, and attain a degree of influence which will increase our means of doing good. It will be readily seen that for the promotion of such a great object we shall not only have sympathy but support, for all those interested in the practical applications of geology will, on public or private grounds, give us their co-operation; and the number of these are many, for they include persons interested in agriculture, mining, building materials, and in all the resources of our soil. As our labors will have a practical result, so will they receive practical support. There is not a landowner of any position but who knows the value of efforts which, by increasing knowledge, add to the value of the surface of his land, or make known resources in its substrata. Thus, too, that large and important class of scientific agriculturists, the new profession as it may be termed of

farmers, have an interest in our success, for some distant discovery may be the means of providing fresh supplies of limes, sulphates, phosphates, and of the valuable mineral constituents of the cultivable soil. To the architect and engineer the investigation of stone, slate, marble, clay, cement, lime, sand, and gravel, for purposes of construction, is a matter of importance. There are many manufacturers who require clay, flints, and china earths for ceramic wares; others sand for glass; and so almost throughout the circle of our industry. There is more particularly that vast branch of our national wealth which is dependent on our mining and metallurgy, and the persons connected with which have an intimate interest in encouraging our pursuits.

There is not a peer in the country who, though he may not have time to join in our work, will not feel that he must have some share in promoting it, and that his name must be inscribed in our list. There is hardly a man of science who will not be desirous to acknowledge that we are assisting his labors.

The heads of enquiry embraced in the yearly reports will vary according to the resources of the district, but they will embrace many features of great interest to theoretical and economical science. They will include:—

Additions to the surveys or maps, resulting from more minute classification consequent on local researches, or the application of general principles of geological science.

The announcement of new minerals, and more particularly economical substances which may become available.

The publication of the discoveries of fossils, thereby completing our paleontological records.

An account of all operations which have laid bare the surface, or penetrated beneath it, as mines, quarries, wells, pits, railway and road cuttings, tunnels, and landslips, and these will afford many matters of record.

Observations on the wells, springs, and subterranean strata of water.

Thermal observations on the surface and in mine shafts, and of superficial and subterranean waters.

Electro-magnetic observations on mineral lodes, an important branch of study, for which there have as yet been limited opportunities.

Records of earthquakes in particular districts, as those carried on by that zealous labourer in the field of science, Mr. Drummond, of Comrie, in Perthshire.

All phenomena affecting the surface should be recorded. Thus near the sea the abrasion of the shores, a matter of deep interest on our eastern coast, will be watched, and new cases of deposition examined. The like operations of rivers should be studied. Then there are evidences of recent abrasion on some of our mountains, which are worthy of notice. So, too, further evidence of boulders, glacier scratches, and ancient abrasions will be contributed, of water-worn surfaces, footsteps, and other local indications. The effect of agricultural operations on the surface should also be studied, as the removal of stagnant water by drainage, the interference with water courses, the mixture of soils and alteration of colour, the removal or extension of woods, all matters of interest in the investigation of the phenomena of the geological periods, and which will contribute to meteorology.

The result of special enquiries into the properties of the building-stones of the district, or of researches for metals, minerals, fuel, manures, raw materials or building substances found elsewhere in analogous formations.

As the system becomes organised, these reports will be published in the local journals, and contribute valuable information, while important facts selected therefrom, and included in our yearly report, and printed in our Transactions, will make the scientific world acquainted with the progress of our knowledge.

The CHAIRMAN confirmed Mr. Clarke's observations on the geological advantages of these islands, and referred to Yorkshire and the Isle of Wight. He dwelt on the practical advantages of geological knowledge, and alluded to Dean Buckland's detection of a mason placing a defective stone on the top of a spire at Oxford.

Mr. MACKIE approved of the proposition of survey committees in connection with the Association, but feared that in some districts there would be a difficulty in obtaining men of adequate knowledge.

Mr. P. L. SIMMONDS spoke at some length on the value of economic geology, and the desirability of extending the operations of the Association to the colonies.

Mr. BOLLAERT was glad that some of his South American friends had joined, and hoped that many communications would be received from abroad. He promised papers for the Transactions.

Mr. G. H. BYERLEY spoke of the advantages of the proposed survey for engineering purposes, and referred to the mistakes, from ignorance, in the application of discharging or absorbent artesian wells.

Mr. F. W. BEAUMONT, in rising to propose a vote of thanks to Mr. Clarke for his paper, took the opportunity to remark that he knew several districts where the formation of this Association would be hailed with great satisfaction. He considered that it would be of very great use in the mining districts generally—South Wales, Cornwall, Staffordshire, Newcastle, Scotland, &c., where much valuable information might be gradually accumulated, with a view to which, and as a guide to the members generally, he took the liberty of suggesting that it would be highly desirable to have Mr. Clarke's paper printed and circulated. He. (Mr. Beaumont) also deemed it desirable that all contributors should be recommended to make their communicated information a mere statement of dry facts, unadulterated with conjectures or opinions; which, however, might be advantageously appended.

Mr. HYDE CLARKE, in returning thanks, said he meant to persevere with the measure he had proposed.

COMPARATIVE VALUE OF FUELS.

At the South Wales Institute of Engineers October meeting a very useful and practical paper on the "Comparative Value of the Fuels" was read by Mr. Mark Fryar, who is already well known to the readers of the *Mining Journal* from his connection with the Bristol Mining School. The fuels are those substances in nature which have been produced by the combination of carbon, oxygen, and hydrogen, and their relative value very much depends upon the proportions in which the carbon and hydrogen enter into their composition; whilst their entire consumption depends upon the presence of oxygen, either as a natural component or as supplied by the atmosphere. Of pit coals the varieties producing the largest amount of heat in the shortest space of time are most valuable as a steam coal—considered simply with respect to their heating properties. But the engineer must employ other guides in selecting coal for steam navigation or locomotive purposes. The difference in the amount of stowage required for equal weights may constitute a coal most valuable for the above uses, whilst the heating property is a little below par compared with coal of the highest calorific value. Coals free from sulphur, somewhat porous, or which will readily break up on exposure to heat, and probably which contain a large amount of carbon, are required for smelting, whilst coals of the highest economic value are the touchstone of success to railway and steam navigation companies.

The lowest calorific effect obtained from wood, as given by Count Rumford, is from the thick shavings of oak, and is expressed by one pound of this fuel raising 24·748 lbs. of water from 32 deg. to 212 deg. Fahr., whilst the lowest of the series of bituminous coals is from a continental mine, and is expressed by 1 lb. of the fuel raising 43·9 lbs. of water from 32 deg. to 212 deg. Fahr. The highest calorific effect from wood is from strongly dried limetree wood, 1 lb. of which raised 40·131 lbs. of water, whilst the highest effect from coal is when the Aberdare Company's Merthyr is the fuel, 1 lb. raising 77·11 lbs. of water. The greatest drawback to the use of wood as fuel is the amount of water it contains.

Peat is a fuel of no mean importance in extent and utility. The great marsh of Montoire, near the mouth of the Loire, is said to be 150 miles in circumference. In Holland and North Germany entire districts are covered by peat formations, from which large quantities of fuel are annually furnished to the various manufactories in their vicinity; and in Ireland we have nearly 3,000,000 acres of peat moor, being about one-seventh of the whole island. The peat formations are a variety of marshy plants, such as sedges, reeds, rushes, mosses, amongst which the moss *sphagnum palustre* chiefly predominates; these have grown in stagnant water in a moist atmosphere, and where evaporation has gone on slowly. At Cappoge, in Ireland, a process has been introduced whereby the peat is very highly compressed by a powerful hydraulic press. On leaving the press it occupies about one-third of its previous volume, whilst it is found to have lost about two-fifths of its weight from the quantity of water expelled, and it is said to have no tendency to re-absorb water. Mallet remarks that experiments at Wurtemberg show that a cubic foot of wood is equivalent to about 2½ cubic feet of desiccated turf. The great objection to this kind of fuel is the high percentage of ash it contains, being sometimes so abundant as to render it quite useless, but some of the Irish peats seem tolerably pure. Peat also varies exceedingly in density—the heaviest varieties weighing as much as 1100 lbs. per cubic yard, whilst the lightest does not exceed 500 lbs. Compared with coal, as employed in furnaces, it is only about half as dense. The best varieties of prepared fuel from peat bear a very favourable comparison with dried wood, being found to contain about 10 per cent. more carbon, 2 per cent. more hydrogen, and 12 per cent. less water. After referring to the lignites, and the theory of combustion of fuel, he concludes by appending a leading article from the *Mining Journal* of May 15, 1858, with which our readers are doubtless well acquainted. This paper forms one of four in the quarterly part of the *Transactions* of the Institute,* the others being on "The Southern Portion of the Somersetshire Coal Field," by Mr. G. C. Greenwell; "Brunton's Ventilating Fan," by Mr. Huxham; and "Cort's Inventions," by Mr. Webster.

* Parts I., II., III., and IV., of the *Transactions* of the South Wales Institute of Engineers are published at our office, price 2s. 6d. each part.

ON THE UTILIZATION OF WASTE SUBSTANCES.

We resume the consideration of the so-called waste products, because the subject treated of by Prof. SIMMONDS is one of the deepest interest to our mineral manufactures. The term of waste products is a loose one, particularly as applied to mineral substances; but it is one sufficiently understood. Old metal in castings in one sense can scarcely be called waste, because the metallic element can be worked up over and over again; and yet in a general sense it may become an article for the waste dealers, for it may be so alloyed or mixed with other substances as to require fresh treatment, or even refining, before it can be again employed; and in such cases its value and applicability are greatly restricted. There are, however, substances better suited for a raw material in their waste state than in their original state. Such is the case with regard to linen rags. Flax is not used for paper, because it is not in such a good condition as rags, for the rags have been bleached, handled, and, what is regarded as of more importance, spun, for it is believed that fibres which have been spun are of more value than raw fibres. Such considerations are worth bearing in mind, for they constitute the natural conditions of manufactures. Rags possessing all the advantages we have named are still relatively cheap, nor can a raw fibre readily compete with them, because its first reduction, which is got for nothing in rags, becomes very expensive. This is the great obstacle in the way of the introduction of raw fibre, however inferior in quality, for paper substances and halfstuff, while it will have been noticed that during the time we have only succeeded in introducing straw, and have failed with a variety of paper fibres, we have introduced an enormous quantity of new fibres, particularly from the East Indies, for weaving, matting, rope making, and furniture stuffing. The consumption of the jutes and China grasses has become enormous. Thus all the efforts to produce paper halfstuff have met with disappointment, while those to produce other economic fibres have been successful, because, as we have pointed out, there are natural limitations to be observed.

These should be regarded by everyone endeavouring to apply a substance in a new form, and we believe that for want of attention to them a great lose of money has been incurred. Thus disappointment has befallen us in the slag manufacture. Doubtless raw slag, or more properly speaking moulded slag, is a building material, and is largely used in the smelting districts for fencing and field walls, and even the rough slag is used for road material; but moulded slag will barely pay for moulding and cartage, and the least thing will give the turn in favour of the stone quarry; but then it may be said the slag-brick is unannealed and brittle. The improved slag-brick or ornament will be annealed, polished, and coloured; but then by such time the expense has become considerable, unless the manufacture be carried on upon an enormous scale, while such articles can hardly have a local vend, and, therefore, must be sent to a distant market, as the East of England and the brick districts, for instance, charged with the expense of transport. This, however, is not all, for the building trades have peculiar arrangements, and agencies would have to be established for the slag products, requiring large profit or commission, and attended with long credits to a bad class of customers, while large assorted stocks must be kept on hand. Thus, in order to carry on an apparently easy trade—that of moulding and annealing slag already molten and contributed for nothing—a very large commercial capital must be employed, and the price of the article be much enhanced. So it is that the slag manufacture has not advanced, and that fields continue to be bought to tip slags into, and be turned into cinder heaps.

The gases of the furnaces are, however, elements much more readily and more practically dealt with. As a means of heating, the waste gases are valuable, as is proved in the foreign, and now in the English, iron-works, where the gases are applied to various useful purposes. The property of heat alone which is wasted in our furnaces is enormous, and we may also say for domestic purposes; and, however great our supplies of fuel are, it is a matter of consideration with mineral staticians whether we can safely indulge in the waste of fuel and heat now going on, looking to the extent of our supplies, the rapid increase of population and consumption, and the apparent progress of our manufactures, in all of which fuel is a considerable and necessary element of our success. The Yankee, who prospects water-sites and reckons water-falls as so much power in dollars, would make a census of the heat in our stacks and furnaces. Assuredly the subject has not received the attention it deserves, and we are fortified in this opinion by the result of the registry of duty of Cornish engines. Cornwall has the advantage in so far of being a relatively dear county for fuel, while too many of our manufacturers, being in coal districts, have cheap fuel and waste it, and it has been a great object to obtain the most work from the engines, though the economy of fuel is only one incidental object. The result of the registry of duty has, however, been in that respect an enormous economy of fuel, because the same amount of fuel will now do a larger amount of work than it did half a century ago. This organisation is a voluntary one, and has well paid the owners of engines for their contributions; but if applicable to Cornwall, it is equally applicable to the whole country, and if applied would result in an enormous saving of coal.

If we consider what the saving of a million tons of coal yearly is worth in an industrial point of view it is a great object, and worth contending for; but in truth a million of tons, or its equivalent in money (say), a quarter of a million sterling, is not the standard of what would ultimately be accomplished. Under all circumstances, a clear national saving must be the result, and we, therefore, strongly recommend what at the present moment there is little prospect of accomplishing—that the consumption of fuel by all steam-engines be registered by the Government. This is a wild and vague idea, but, if steadily persevered in, will be accomplished. The compulsory and voluntary inspection of steam-engines is proceeding; and the smoke nuisance legislation is another measure of engine police. A very little exertion will obtain a registry of duty in London, Manchester, Birmingham, Glasgow, Leeds, Belfast, Sheffield, and other great seats of steam-power, and the system established in a few places would reach to all. If the engineers were on the alert they would secure to themselves a very large branch of business by a little money contribution and some agitation. They have only to enlighten public opinion, put the press in possession of the facts, and act upon the Legislature, and they would obtain the general appointment of inspectors, whose functions would include the registry of duty. Cornwall has set the example to the world, and would give countenance to such a movement, and the whole expense of the registry and inspectors would be well paid out of the local rates, with some aid from the Consolidated Fund for the general organisation. Prizes could then be given to deserving enginemen, and a welcome boon be thereby confered on the working classes. A small engine tax might be imposed towards defraying the expenses; but the object is one of national importance. In foreign countries the registry and inspection are undoubtedly the means of a great economy of fuel.

The next point to the economy of the fuel put into the furnaces is the utilisation of the heat and the recovery of the waste products. Fuel can undoubtedly be saved by millions of tons, though for that matter there are large iron and other works having the free use of collieries that really do not know how much coal they do use. Here there is a good opening for enquiry, As the Cornish engine returns show us the minimum of consumption of coal for steam-engines, so will returns of iron and other works in the dear fuel countries of the Continent give us minimum standards for the consumption of fuel by such works. The records of locomotive duty are likewise very valuable, for the railway companies, finding how costly an article fuel was, arranged a system of record, and, by giving as premiums to engine-drivers the value of a portion of the fuel first saved, have succeeded in ascertaining what is the minimum of fuel necessary for an engine and of fixing it. The waste, be it remembered, is only partially attributable to proprietors, managers, and firemen, but chiefly depends on the furnacemen, and the check is to know the minimum of fair average consumption, to allow that to the furnaceman or fireman, to give him a premium on what he saves below it, and to fine him for all consumption above. In some of our metallurgical works it is really cruel to see the consumption of the coal, of which tons upon tons are burnt up in the ash-pits. The applicability of the waste gases is, as we affirmed last week, an indisputable fact, and practically economical, but in very few works is advantage taken of the application. This state of affairs is greatly owing to the want of development of mining and metallurgical institutes; but the South Wales Institute and the North of England Institute will ere long bear good fruits.

A manufacturer who resides on his own works, troubles himself little with books, does not allow himself to be troubled with speculators, goes on jogtrot, and resists every suggestion of innovation; but if he attend an institute, as he cannot help doing in time, he is sure to hear some paper on a new invention or process bearing on his business. He and his friends render invaluable service, their prickles stand up at anything new, and they raise every objection they possibly can. Most of these objections are met on the spot, and disposed of, but some have to be met by further experiment of the inventor or objector. The manufacturer has got some old prejudices the less and some new notions the more, and the first time there is a change in his works he tries the new process, or his own modification or improvement of it; for one result of a practical man taking up any notion is to set his mind to work upon it, and thereby very certainly to improve it. Hitherto the Institution of Civil Engineers has been able to do very little for metallurgy, as it has had other claims to its attention; but the formation of the special institutions will remedy this defect, and bring a great moral influence to bear on metallurgical interests. Already many of the leading men connected with iron and other works have joined the South Wales Institute.

The utilisation of the waste products of furnaces is another practicable subject, which deserves more attention. On this head more investigation is to be desired. The furnaces in our iron, copper, and other metallurgical works most commonly discharge their smoke right into the air, and it is dissipated. This is defended on the ground that a better draft is got by such direct discharge, and that to adopt any circuitous shaft, which would cause a deposit of the solid matters of the smoke, will reduce the draft, and thereby slacken the operations. This is altogether a false suggestion of prejudice, for there are many chemical and metallic manufactures in which it is absolutely necessary to condense the fumes by flues and chambers, and in which no loss of draft is experienced. There are likewise works in which long culverts or flues are optionally used, as, for instance, in the case of the very long culvert at Cwm Avon, in South Wales, and in these cases there is indisputable evidence that the draft is quite as good as in a combination perpendicular stack, or in single stacks to each furnace. The general evidence of metallurgical experience is that in many cases a very great saving of produce may be effected by the use of arrangements for condensing the fumes. It is, however, a lazy convenience to discharge the fumes of blast furnaces at once, perfectly regardless of the consequences. This is sometimes done to save plant, for, as a matter of course, a long culvert or flue, climbing we will say to the top of a high hill, or carried a quarter of a mile off, will add to the expense of plant.

Whenever the manufacture is that of a metal of some value, as tin, copper, or silver, the metallic contents of the refuse always repay its collection, but very little regard is in most cases paid to arsenic, sulphur, and the other mineral contents, which are wasted for want of chemical knowledge and appliances. We believe that in the neighbourhoods of chemical works for making sulphuric and arsenious acids, paints, &c., enormous quantities of valuable elementary substances are wasted, and this brings us to another educational want—the want of institutions in which industrial chemistry can be discussed. A chemical society is commonly a society of chemists, where some recondite question is discussed, perhaps of organic chemistry, relating to the physiology of flesh-formers or some point which, though in the course of many years it may become of scientific value, is not of the least value or interest to the manufacturer. When we consider how small is the range of chemical knowledge and of chemical studies possessed by most of those engaged in chemical practice, we may well conceive what little interest our manufacturers, and even our chemists, feel in abstract chemical papers and discussions, whereas at the Society of Arts they will muster strongly on some practical subject of chemical manufacture. A man who has not received a good training in a chemical college, or school of mines, most commonly contents himself with the manipulative chemistry of his own branch, and this ignorance reacts very materially on our prosperity. Thus in our mining districts many suppose we have plenty of chemists because we have plenty of assayers, and wonder that so little is done for mining analysis and the detection of valuable substances; but it is a fact that many of our ablest copper assayers, men in good practice, and on whose certificate undoubted reliance can be placed, cannot, or will not, make any other metallic assay, still less will they undertake any general analysis. Such an operation can never repay men who, not being in the general current of practice, have to learn each operation as they carry it out.

HOUSEHOLD WORDS.—No. I.

"Money makes the mare to go."

GOLD AND SILVER.—These are "household words:" though their expression may smack of vulgarity, they are universally understood. Whether it be constituted as cowries or crowns, pistoles or promises to pay, still that most calculated to "speak all languages," and best calculated for the use of civilised society and the commerce of the world, is that formed of the precious metals, as they are called. These, from many peculiarities, are admirably adapted to the purpose: their rarity prevents any sudden or undue depreciation from over supply; their ductility, and consequent trifling loss from abrasion; their freedom from injury by oxidation; their peculiar sound, specific gravity, and beauty, point them out as being in every respect *the* metals to represent certain values in small compass. That they have been so employed from very remote ages all history, as well as extremely rude coinages, sufficiently prove. The extremely beautiful colours seem even in savage life to have attracted attention, for we find, on the discovery of America, that though the natives valued iron more than the precious metals, yet they had numerous personal ornaments made of them.

It is not on these points we propose to consider these subjects in our present paper, but to treat of them as to the matter of supply and demand: even in these important interests the same laws as regulate all others evidently adapt themselves. It would have been supposed, and, indeed, was by many held as a certainty, that the recent abundant supplies of gold from Australia and California, in addition to the old sources, would have disturbed and reduced the standard value of that article; yet the amazing imports seem to be all absorbed without the slightest difficulty, or the least signs of being cheapened. The same may be said of silver, which is so much more easily procured, and is so much more plentiful, yet, notwithstanding the more effectual working of its mines abroad, and improved processes at home, the demand and supply seldom causes its value to be raised or depressed beyond a mere atom. For these reasons mankind, as if by common consent, if not of necessity, have adopted them as their standard of value; hence they may justly be said to speak all languages, and, as our motto indicates, to "make the mare to go."

By a little attention to the wants of mankind, and the rapid development of social domestic comforts and luxuries, consequent on the accumulation of wealth by industry, as well as the immense impulse given to the increase of the human family by civilisation and traffic, we shall find sources of consumption that were as nearly as possible excluded from our forefathers; the consumption of metals is, and always will be, regulated by the same impetus. Take, for example, the single modern invention of photography. The consumption of silver in the various processes of this art would at first sight appear trivial and unimportant, yet we are informed by persons employed in the manufacture of these materials that the quantities of this metal used is astonishing, amounting to some tons in the course of the year. The amount that is consumed every year in the formation of plate and plated articles is increasing annually as society improves. There is scarcely a household but has some piece of "family plate," either inherited or purchased; these are for the time withdrawn from circulation as effectually as if in the parent mine.

The discovery of plating by galvanism, and thus rendering articles of domestic use exquisitely beautiful at a cheap rate, and when applied to nickel as a base very nearly rivalling silver, not only in appearance but in utility, has caused another source of immense absorption of the metal, for in these cases the metal is absolutely consumed by abrasion, and is lost for ever, in addition to the many other modes of its abstraction from cir-

culation. In gold the same remarks apply, but with a tenfold force. What house of any pretensions can be entered now but the walls are graced by picture and looking-glass frames? what table but is covered with porcelain in which gold is not a part of the ornamentation, and that, too, to a vast amount? A singular, yet important, branch of British staple trade has lately availed itself of this useful, though costly, material to forward its interests—the Manchester *cotton trade*. It had been found that the bronze and other imitations of gold and silver used in decorating and labelling their muslins, cambrics, and other valuable manufactures, when exposed to the vicissitudes of heat or cold, or to atmospheric influences, change their colour, and instead of beautifying, absolutely deteriorate the goods, and spoil the sale thereof. As well it might; for the purchaser perceiving one to be a sham, though itself bearing the impress of *genuine*, the article to which it was attached might be, and probably was, sham also. It was found on trial that gold only would retain its lustre, and gold, accordingly, is extensively used. We were informed by Messrs. Lane, goldbeaters, of Birmingham, that this is one of the most important branches of their business. Now, in these three instances the precious metal is absolutely lost for ever, notwithstanding the little loss gold suffers by abrasion; the quantity thus annually distributed is truly surprising.

The amount now applied to personal ornament, and to the necessities of mankind, is enormous, compared to what was so employed in the days of our forefathers. Then a gold watch and chain were the emblems of nobility, at least; at the present day, a walk through the streets of London, or any country town even, will satisfy on that score. The well-filled purse, in consequence of monetary arrangements now, is represented by coins instead of paper. The bullion at this moment in England, great as it is, is scarcely equal to her wants and requirements; whilst on the Continent it is lamentably deficient. A dozen Australias and Californias will not meet the demand; but its production will facilitate commerce, increase trade, create confidence, and spread comfort and happiness.

The gold digger and silver miner may pursue their avocations with industry and perseverance, under the assurance that, from the above reasons, if no others be advanced, their trades will not fail, or the value of their produce be reduced during their day, at all events. G. HENWOOD.

CORNISH MINE PHOTOGRAPHS—SECOND SERIES.—No. XII.

THE CARGLAZE, OR OPEN TIN MINE.*

Amongst the many interesting scenes with which Cornwall abounds few will at once prove so entertaining to the archæologist, the geologist, or the mere casual observer, as this celebrated mine. The history of its commencement is lost in obscurity, but the vast size of the mine itself affords abundant proof of extreme antiquity, whilst the numerous works at surface and immediately adjoining, which have been wrought exclusively for extracting tin from the backs of the lodes, evidence the origin of this prodigious undertaking. The mine is situated on the apex of a high hill, about 1½ mile from the beautifully situated and thriving market town of St. Austell, to which place access will shortly become very easy, as one of the main stations of the Cornwall Railway will be there. The circumference of the shaft, or entrance to this mine, if measured in all its eccentric sinuosities, would probably exceed a mile. At first view, from the edge of the abyss, it presents the appearance of an immense bowl-shaped excavation, save that it partakes of an oval instead of a round form. Its length from north to south being about a quarter and its average breadth an eighth of a mile, and is 20 fms. deep. The stratum in which the tin ore is found is a kind of decomposed granite, or growan as it is locally termed, traversed by great numbers of small veins, or lodes, of tin and spar: these may be easily detected in the sides or walls of the mine, which being of a colour nearly approaching white, display them to great advantage, as these minerals are of a blackish colour. The lodes vary in their bearings, some being nearly vertical, others having various inclinations or dips: the majority of them have an east and west direction, or strike, but a little attention will enable the student or observer to trace cauntер veins as well. Most likely there is no place in Cornwall where the practical examination of tin veins by the novitiate can be made with equal facility; indeed, we know of no spot at which a "field lecture" on the subject could be so advantageously given. The great extent denuded, the privilege of examination by daylight, the depth at which the lodes may be traced in their descent, the junctions and the splitting of mineral veins here to be seen *in situ*, are opportunities which can scarcely be over valued; but, strange to say, they do not appear to be thoroughly appreciated by students in geology.

To the admirers of the picturesque a rich treat is afforded. The former workers left many parts remain that were not rich enough to pay for removal; the effects of the weather, as well as the pick of the miner, have converted these blocks into the most fantastic forms and groups, presenting in some instances sharp peaks and sugar-loaf miniature mountains; others are like huge masses of snow; the whole are so variegated in colour by the oxidization of the minerals contained therein by atmospheric action, contrasted with the dazzling whiteness of the precipitous cliffs at present working, form an unique *coup d'œil*, which is further heightened by the ruins of several abandoned stamping mills, which were long since used for crushing the ore raised from the mine. These are now overgrown with lichens and mosses of every variety of colour, and abound in the most luxuriant and graceful fern foliage. That necessary appendage to all landscape beauty, water, is to be seen in a bounding stream of considerable volume, running for about half the length of the excavation. This to a stranger presents a singular appearance, being as white, and of nearly the same consistency, as milk, from the charge of china-clay it receives at the present works. This stream was anciently used to wash out the tin ore and work the stamping mills before alluded to. The value of the china-clay at that period was either unknown or unheeded. Be that as it may, it is now sedulously preserved. An adit, or subterranean tunnel, has been cut, at an enormous expense, to convey the liquid through the side of the hill to receptacles of several acres in extent, for the purpose of deposition, solidifying, and drying for the market. The process of preparing china-clay is so similar in all the works, that a description of the method practised at Carglaze will serve to illustrate them all.

At the upper end of the works the growan, or wall of the hollow, is upwards of 60 ft. deep: this growan, or decayed granite, it is scarcely necessary to observe, consists of felspar, quartz, and mica. The felspathic substance is purely white, and is the portion so highly valued. This growan is dug by workmen, and is subjected to the constant action of the stream before mentioned, by which the felspar and mica become separated; the quartz, tin, shorl, and other mineral substances are at once retained by their weight, whilst the felspar and the mica are conveyed by the stream through the tunnel to the first series of depositories, termed mica pits, in which, from the superior specific gravity of that substance to the fine clay, it is precipitated, and the felspar conveyed to numerous other fields or pits, of which the last contains the finest qualities. These are filled to such an extent as to afford a depth of about 1 ft. of clay when dry. The water, when perfectly clear, is pumped off, and the rest desiccated by the atmosphere. The clay is cut into balls, or lumps, of about 1 ft. square, is rendered perfectly dry, by being placed in open sheds; after which it is deprived of all extraneous and fatuitous impurities, and is then the china-clay, or kaolin, of commerce, and is shipped to nearly all parts of the world; for, exclusive of its extensive consumption in the manufacture of earthenware and porcelain, it enters largely into the composition of writing and printing papers, bleaching and stiffening calicoes, paper staining, &c. No use is at present found for the refuse mica, though doubtless science will eventually realise the desideratum.

At present the Carglaze is worked for the clay alone, the small quantity of tin discovered not being anything worth mentioning. The uncertainty of mining may at any moment reveal a discovery of importance. The limits of our paper preclude any further description of the interior, though we have dilated on not one-half of its attractions; we, therefore, ascend by the crooked and steep pathway we descended.

If the visitor be fortunate enough to be on this eminence on a fine day, a most extensive prospect may be enjoyed, and one scarcely to be equalled in extent or variety. On the north are the great china-clay works, the most extensive in the world, from which upwards of 20,000 tons are annually exported. Here, too, is the peculiar variety of semi-composed granite, termed china-stone, of which about half that quantity is raised. In the extreme distance, on the north-east, may be distinguished Cornwall's two highest mountain-like hills (Roughton and Brown Willy); on the east the rugged Luxilian and the Great Caradon hills, with their rich quarries and mines; beyond is the Kit Hill, with its monument-like mine chimney on the top. All these have been described in our previous papers. Further, on the south-east, is the entrance to Fowey Harbour; near the obelisk visible on the promontory are the Fowey Consols, so justly celebrated for their prodigious returns; nearer to the spectator is the district of Par Consols and St. Blazey; the Port of Par, wholly constructed by the late Mr. Treffrey, may be plainly distinguished, as well as the little harbour of Charlestown, whence the produce of the ground on which we are now standing is shipped; the middle distance is made up of mines that have realised enormous fortunes for their lucky proprietors, amongst which properties may be enumerated Pembroke and Crinnis, Great Crinnis, Boscundle, the old Apple Tree, and the St. Austell Consolidated Mines; the aggregate of whose produce in tin and copper would stagger belief, amounting to millions! Looking due south, the visitor will be delighted with the enchanting view of Charlestown Bay, apparently at his feet, studded as it at all times is (except in gales of wind, when we presume no excursionist will visit the Carglaze) with numerous coasters, fishing boats, and shipping from the ports of Charlestown, Fowey, Par, &c. The extreme point on the left is at the entrance to Fowey Bay; that on the right is the Dodman, or extreme point leading to Falmouth; within this bay are fisheries of considerable extent. At Polperrow and Mevagissey the pilchards are frequently secured in large quantities, but never to the extent mentioned in our paper relating to this subject in connection with St. Ives. On the south-west is the town of St. Austell, whose prosperity depends entirely on the clay works and mines in the locality. The extensive mines on the west are the Polgooth, Great Hewas, St. Austell Consols, and Dowgas Mines. These, with those before enumerated, comprise the St. Austell district. Far off in the distance may be seen many others, the notices of which have formed the subjects of previous papers. No person can ascend these heights without being struck with the number, prominent position, and beauty of the church towers; from this place a large number may be observed. To judge aright of the extent, variety, and worth of this celebrated county's productions such visits are absolutely necessary; the mere casual observer does not see, nor can he appreciate, the extent and value of the St. Austell clay and mining district accurately, unless such a pilgrimage be taken, and to no better point can it be directed than to the subject of our present Photograph. GEORGE HENWOOD.

* Carglaze is said to mean a view from a hill, as Pentireglaze means a view from an headland.

CORNISH MINING MAXIMS.—No. X.

"THE MAYOR OF MARKET JEW."

Like most mining parts of Great Britain, the various towns as well as individuals in Cornwall are known by some sobriquet or nickname. Whence this ancient custom arose we know not, but we find it prevalent in Lancashire, Wales, and the North of England, and in all probability this practice has been the origin of the great variety of surnames. Be this as it may, the cognomen of many families frequently display a singularity, quaintness, or witticism, that bears strong testimony in favour of such an hypothesis. "The Mayor of Market Jew" is, as may be inferred from the above remarks, a myth, a sort of badinage, used by the inhabitants of the neighbouring villages to ridicule the population of that ancient market town; but the addendum to the apothegm is so applicable for general use that it has become a complete axiom throughout the county at large. We, therefore, insert it for the benefit and amusement of the public generally, and let them enquire whether or not among their own sphere they can discover a "Mayor of Market Jew," or *a man who sits in his own light*, for he is the veritable "Mayor of Market Jew."

It may not be uninteresting here to give a brief history of this village, which was undoubtedly once of far greater consequence than at present, though it has never been endowed with corporate honours. It is said to have been one of the principal entrepots of the ancient tin trade of Cornwall—that the Jews and Phœnecians frequented it for the purchase of that mineral, and the sale of their various commodities. The famous St. Michael's Mount and subjacent rocks are by many supposed to have been the Cassiterides, or islands of tin, alluded to by Strabo, Pliny, and other authors. Though the Islands of Scilly claim the distinction, certainly the position of Market Jew, or Jew Market, as well as its name, implies a strong argumentative presumption in its favour. The place is in the immediate locality of extensive stream works in the parishes of Sancreed, Madron, Morvah, Gulval, Ludgvan, St. Erth, Germoe, &c.

The town at present is known as Marazion. Its principal support is still from the adjacent mines, the chief one of which is the celebrated Tolvadden, or the modern Cornish mining wonder. Near it is the Great Wheal Fortune, once so exceedingly rich as to have returned more than a million of money. The Marazion mines, the old Neptune, and many others, might be enumerated, but they cause us too great a digression.

Our Maxim, in brief and homely phrase, expresses a most important consideration—a man sitting in his own light; or, in more erudite language, by his own waywardness, self-will, and folly, defeating his own ends, disappointing his own expectations, and overreaching himself. Most of these quaint adages are admirably adapted to the cant idiosyncracy of the Cornish people, who avoid anything like detail if they can convey the same ideas in brief sentences, particularly when a smack of sarcasm is engrafted. We believe the maxim is confined to the county of Cornwall, where it is well known; but, as we have before hinted, it by no means expresses the limits of the sphere of action of "Mayors of Market Jew."

These phrases are exceedingly useful amongst such a population as that by whom they are used. Many are becoming obsolete; this is one of the most popular, most extensively used, and, therefore, best preserved. And now let us ask the reader, has he in his experience never met with a character of this description? If not, verily he is a singular man. We confess to have done so frequently, and yield to the soft impeachment of having more than once been in the predicament; but if our readers have not yet seen or been such, let them read, mark, and recollect the old Cornish maxim—"The Mayor of Market Jew." GEORGE HENWOOD.

THE "GOVERNOR" SAFETY-CAGE FOR MINES.—By far the greater number of accidents in shafts arises from the fall of the cage, either owing to the breakage of the suspending rope, or the derangement of some part of the machinery. In all inventions hitherto brought under the notice of the public the actual breakage of the rope has been necessary to bring the safety apparatus into action, and unfortunately it has frequently happened that even when the rope has broken the apparatus has failed to act, the sacrifice of life being in too many instances the consequence. This circumstance, however, owes its existence in nearly every invention we have seen to the same cause—the machinery of the apparatus is employed to put it into operation; thus, when it was of vital importance that it should act, it has been found wanting. Now, undoubtedly, where levers, springs, and such contrivances are to be depended on for obtaining a successful result there are many probabilities that accidents will occur, although the safety apparatus is attached to the cage, and it is but fair to attribute to that the apparent neglect on the part of colliery proprietors to provide their pits with patent safety-cages. With a full knowledge of these facts, Messrs. Brown, Westhead, and Co., of Manchester, are now manufacturing a safety-cage, in which the self-acting machinery is employed, not to bring the apparatus into action, but to prevent its acting so long as there is no accident, the result of an accident being to derange the machinery, and thus prevent the fall of the cage by leaving it to itself. The chief feature of the invention is the application of a pair of governor balls to the top of the cage; these acquire a momentum through the medium of a friction roller, which constantly presses against the guide-rod—a driving band or connecting-rod communicating therefrom to the governor. So long as the speed of the cage does not exceed that for which the governor has been set, its motion up and down the shaft is unimpeded, but when, from any cause whatever, a higher velocity is attained the governor balls open, and releasing a detent brings the machine into action. In cases where the new cage was employed for the descent and ascent of men, it is proposed also to apply a self-releasing hook, so that upon the cage being over-wound but a single foot it would be released, and the safety apparatus would take effect. The whole secret of the invention, so far as its immense power when in action is concerned, appears to consist in the use of strong eccentrics, to grip the guide-rods, so arranged that in their natural position they prevent the descent of the cage—a small detent, which is easily displaced, alone preventing the action. Considering the invention from every point of view, we have no hesitation in pronouncing it to be one of the most effective ever patented.

NOVEL APPARATUS FOR VENTILATING MINES.—Mr. G. R. Scriven, Philadelphia, provisionally specified an invention which consists in the combination of a cylindrical drum of uniform diameter, revolving on journals, which may by preference be horizontal, one of which is tubular from the end of the drum, with a spiral pipe or passage wound or coiled around or within the said drum, open at one end so as to freely admit air and water and other fluids in contact with the outer surface of the drum, with a free and unobstructed passage through such coil into the said tubular journal, into which the other end of one pipe or coiled passage enters water and air-tight through the said tubular journal into a vertical or other stationary pipe attached water and air-tight to it by the usual method of packing, and in which it turns out of one side pipe at its opposite end. A reservoir enclosing the cylindrical drum, and in which it revolves, partly immersed in water or other fluid, provided with air and water feed pipes, and a float valve to regulate the quantity of water therein. A reservoir, water and air tight, into which the coiled pipe communicates through the tubular journal and the air and water discharge pipe. When necessary, the discharge water pipe conducting back the reservoir, and an air discharge pipe for the escape of air. And, lastly, a contrivance to receive the water or other fluids at its maximum point of elevation in the vertical pipe, and transfer it back to the cylindrical drum, there to act to one extent of its gravity as a motor or driving power, any deficiency thereof being supplied by any known motive power, or by hand labour, when so desired. In using this apparatus for ventilating mines he merely inserts the air feed pipe of the reservoir down into the mine, and lets the cylindrical drum revolve partially immersed in water; at each revolution of the drum a quantity of air and water is taken up into the coil of the drum, and thrown off at the outer end of the vertical pipe in alternate jets of air and water, thereby tending to create a vacuum in the reservoir, but a supply of air is perpetually flowing into the reservoir through the air feed pipe, which will be the same in kind as that in the mine, into which the feed pipe is inserted, while the water, consumed by its own gravity, flows back into the reservoir, and is thus perpetually used over again; the air and water so thrown off is emptied into the receiver, the air passing off thence through the air discharge pipe, while the water flows back, as before mentioned, into the reservoir through the water discharge pipe. The apparatus may in such a case be either in or without the mine as circumstances may require. In the latter case the receiver is unnecessary, and he only requires a return pipe for the water to flow back into the reservoir in its stead. In case it is desired to introduce fresh pure air into a mine without changing the location of the apparatus, he merely reverses the feed and discharge air pipes. The air feed pipe now admits fresh pure air to flow into the reservoir, while the air discharge pipe of the receiver is turned down into the mine or other enclosed place, and these conduct the pure air discharged at each revolution of the cylindrical drum into the receiver, the water flowing back into reservoir.

THE COAL TRADE OF THE UNITED STATES.

The tables which record the coal trade in the United States begin with the year 1820, which was in the infancy of men now in their prime of life. For that year, 365 tons represent the total. What a text is in this initial fact and point of observation? How gradual, how progressive, since that time have been the discoveries of coal by science and by adventure over the United States? Pennsylvania, however, which was the first to unfold the treasures of her mines, is the scene of the largest operations in this great trade; though in her sister States, south to the tributaries of the gulf and west to the ocean, coal beds are found, and made to yield up their valuable fuel. To ascertain the exact actual coal trade of the United States, there are no means in existence; for outside of Pennsylvania and Maryland registers of coal tonnage are not accessible; and even in the bituminous region of Pennsylvania, which covers more than 10,000 square miles of her surface, it is not easy to acquire correct information of the whole number of tons mined. However, with all these drawbacks to a perfectly satisfactory exhibit of the coal crop of the United States for 1858, we venture, nevertheless, with the data in our possession, and with estimates where we have no returns, to submit the following as the approximate yield of the coal mines in the United States in the year 1858:—

	Tons.
The three anthracite fields of Pennsylvania	6,750,787
Broad Top, Blossburg, and Barclay coals	164,933
Alleghany and Pittsburg coals, carried on Pennsylvania Railway	892,687
Monongahela Navigation Company's coal tonnage	917,738
Estimated river coal trade of Pittsburg, exclusive of Monongahela Navigation	125,000
Estimated product in other parts of the State	500,000
Total for Pennsylvania	8,793,095
Cumberland region	642,725
For Ohio, in 1857, the coal product, partly from returns and partly by estimate, was put down at 2,394,000 tons, so that for 1858 it will be safe to put it down at	2,250,000
And for the States of Virginia, Kentucky, Tennessee, the Carolinas, Georgia, Alabama, Arkansas, Missouri, Iowa, Illinois, Indiana, Michigan, &c., and the Territories, say	3,000,000
Total coal product of the United States, 1858	14,685,820

—*United States Railroad and Mining Register.*

COPPER MINING IN THE SOUTH OF SPAIN.

When in the sixteenth century the genius and enterprise of her navigators had laid open to Spain the almost fabulous riches of a new world, her own internal resources—although in some respects rich and important beyond those of any other European country—seem to have been gradually neglected, and arts and commerce, which up to that time had been successfully pursued, appear to have dropped into a state of disuetude. Intoxicated with anticipations of boundless wealth from the golden regions of the West, the means of acquiring it by a more tedious process became distasteful, and this feeling seems to have been shared with the people of Spain even by the Government.

From a very remote period the mineral wealth of Spain has been a remarkable and characteristic feature of the country. In the most ancient times the Iberian lead mines brought Phœnecian commerce to her shores; and during the Roman occupation the mines of lead and copper and quicksilver were actively and profitably worked. Actuated by the same indomitable spirit and concentrativeness which conducted them during the time of the republic to conquest wherever they turned their arms, the Roman people, even when applying themselves to industry, have left behind them unmistakeable evidences of their skill and perseverance. Within the present century there existed in the south-eastern part of Spain, in the provinces of Murcia and Almeria, enormous mounds of lead scoria, from which, owing to the insufficiency of the ancient processes of extraction, the lead had been but partially removed, and from which the improved methods of modern times have enabled metallurgists of a later day to obtain a rich yield of metal. The most remarkable proof of the skill and energy of the Roman miners is not found, however, in the lead mines of the provinces just mentioned, nor in the quicksilver mines of Central Spain, but in a locality which has been hitherto but little known beyond its own boundaries, although it is, doubtless, one of the most interesting and valuable in the world in a mineralogical point of view.

In this district mining seems in a general sense to have died out with the Romans themselves. The lead mines of the south-east, the smelting works near to Carthago Nova (the modern Carthagena), the quicksilver mines of Almaden, appear all to have remained in active operation after the Roman period, up to the time of the discovery of America; but in the district of which we purpose to give some account all activity vanished with the enterprising and dauntless people in whom it originated, and with one solitary exception, the numberless productive mines which in ancient times characterised the locality, until within comparatively a few years, have laid absolutely quiescent and unfruitful. When, after the discovery of South America and Mexico, the expectations of the Government and people of Spain were raised to an inordinate height as to the metallic wealth obtainable from the New World; all mining enterprise in the mother country was stopped by law, the Government retaining in its own hands three great mines—one of lead, in a locality which has since become known through the establishment of the Linares English company, one of quicksilver at Almaden, and the third of copper, at Rio Tinto, in the province of Huelva. These mines have been worked up to the present time imperfectly, and entirely without the assistance of improved appliances; occasionally they have been farmed out to speculators, but have been again taken into the hands of the Government, by which they are at present worked.

In 1825 the law prohibiting the working of mines by private individuals was repealed, and since that time mining operations have been vigorously pushed forward, but according to rude and antiquated principles; and although the mines of Spain are at this moment the most productive in Europe, and the country itself must be considered a most valuable mineral region, it is well known that not one-fourth of the riches are obtained from the mines which they are capable of yielding. In the province of Huelva, wherein the great Government mine Rio Tinto is situated, there exists an accumulation of deposits of copper—if such an expression is admissible—which extends in an easterly direction into the province of Seville, and to the westward into the southern part of Portugal, reaching to the sea. It is a remarkable and even a surprising circumstance, that although the Rio Tinto Mine is known to have been worked from the time of the Romans to the present day, during not less than 1800 years, and the workings can be traced back century after century, the capabilities of the district remained unheeded or undiscovered until a very late period. This is the more extraordinary, as the evidences of the presence of copper are extended beyond the immediate neighbourhood of this mine, and the waters of the river from which it takes its name, Rio Tinto, are impregnated with the metal.

The mass of copper existing in this mine can in no respect be compared with the lodes of Cornish and other mines, it is nothing less than an immense aggregation of mineral of a uniform character, compact in structure, and containing scarcely any foreign matter. The deposit, as it runs through the Rio Tinto Mine, acquires in some places a width of 100 yards, and is of an average width of 80 yards throughout. Its depth its incalculable, as at present, although the mine has been sunk to a sixth level, the mass of ore increases in width, and it is impossible to form any idea of the vastness of the mass in which the miners are burrowing here and there, meeting in every direction nothing but the pure mineral. An eminent English mining engineer, who visited this mine, stated that it was with absolute wonder he found himself, in passing through the different workings threading in every direction a solid deposit of pyritic copper ore, not existing in lodes, but in one boundless compact mass—floors, sides, supports, roof, all of the same character.

The percentage value of this ore in copper is small, seldom exceeding 4·5 per cent.; although since other mines have been opened in the same district deposits have been discovered containing a very much higher percentage of the metal. It is, however, upon the ore of small value that the operations at Rio Tinto are carried on; this mineral contains copper, iron, sulphur, and a little earthy matter, the sulphur, on the whole, amounting to about 45 per cent. The ore is too poor generally to bear the cost of exportation—at least, such was the case until a very few years; it is, therefore, worked on the spot by a peculiar process, which has only been adopted in a few localities, and which is only applicable to sulphuretted ores. This process, which is called cementation, has been long employed in Sweden, and is now used upon the Wicklow ores at the mines; precisely the same treatment, in principle, is applied to the alum shales in the North of England, in the manufacture of alum. The process itself consists in roasting the sulphurets of iron and copper in the open air; a huge mound of the broken up ore is so piled upon a foundation of brushwood that when the latter is ignited the flame can gradually penetrate the heap. The ore, owing to the large quantity of sulphur it contains, burns readily, emitting a great deal of sulphurous acid gas; at the same time the sulphur combined with the copper, and a portion of that combined with the iron, is oxidised and converted into sulphuric acid, which remains in union with the copper and a portion of the iron. This process of burning, or calcination, is continued upon the ore during five or six months, until, indeed, the sulphur begins to be exhausted. The result of the calcination is the conversion of the sulphurets of copper and iron, which are insoluble in water, into sulphates of the same metals which are soluble, so that when the ore is afterwards treated with water in great tanks employed for the purpose, the copper, with some iron, is washed out and remains with the water, thence it is recovered in the metallic state by plunging in the liquid plates or pigs of iron, which, according to a well-known chemical action, causes the precipitation of the copper in the form of metal, which has afterwards to be refined and run into ingots for the market.

By this simple and inexpensive process thousands of tons of the poor ores of the Huelva Mines are now being reduced, but in addition to this a new state of things has arisen, which gives a further value to the district. It is generally known that the enormous quantities of sulphur which are annually consumed in this country in the manufacture of sulphuric acid, were for a long time drawn almost exclusively from the kingdom of Naples—a circumstance so important to this country as even to possess a political influence. The ores of Huelva, containing as we have seen a great excess of sulphur, which can be easily obtained from them in burning, are perfectly suitable to the production of sulphuric acid, and from this a large trade has sprung up, the ore being now introduced into this country, and after being deprived of the sulphur by the vitriol manufacturers in the neighbourhood of Newcastle, Glasgow, and Liverpool, are sold and smelted as copper ores in the usual manner.

The mine of Rio Tinto is the type of the district, with regard to the character of the ore and the system of working it, but within a few years the locality itself has received the attention it merits from the Spanish Government. A proper survey showed that the Romans had extended their mining operations as far as the deposit of ore can be traced; ancient adits and shafts have been discovered in all directions, and when cleared from the accumulated detritus with which they are choked, have, in almost every instance, led to masses of ore similar to, though generally less in extent than, that of Rio Tinto. The consequence has been the reopening of many of the old mines, which are now in a state of productiveness, yielding a prodigious quantity of ore, part of which is exported for its sulphur, and the rest treated by the process described, to obtain from it the copper in the metallic state.

To the geologist this district must afford as much interest as to the miner and miners-

logist, the situation of the deposit of ore being most remarkable with reference to the rocks in which it is found. The general character of the district is clay-slate, with protusions or eruptions of porphyry, which has evidently been thrown up so as to cause disruption and extensive disturbances of the slates.' It is not as veins traversing the rocks that these metalliferous deposits exist, but as masses filling cavaties between the slate and the porphyry. Viewed generally this district of Huelva and part of Seville is, therefore, one that ought to attract the attention not only of miners but of the scientific mineralogist. Commercially, it is daily being brought into notice both in France and in England.—T. W. K.: *Artizan.*

TREATMENT OF ZINC ORES.—An invention which relates to the treatment of the ores of zinc, and to the manufacture of spelter, and consists in utilising the sulphur contained in the sulphide of zinc, in the mode of treating the carbonate of zinc for the purpose of obtaining carbonic acid, and other products therefrom; in the mode of obtaining products from the zinc vapours passing through the flues of retort furnaces used in spelter making; and in treating the residue left in the retorts after the process of reduction is completed, has been provisionally specified by Mr. C. Crockford, of Holywell, Flint. He so constructs a furnace for calcining the sulphide of zinc, that the sulphide is introduced continually in small quantities at one end of a chamber, the floor of which is heated by a fire and flues underneath, and exposed in its passage from one end to the other of the said chamber to the action of a current of heated air, by which the sulphur is converted into sulphurous acid, which is carried off in a nearly continuous stream, and may be applied to the manufacture of sulphuric acid, or to any other purposes for which sulphurous acid may be required. By the construction of such a furnace, from which a practically continuous stream of sulphurous acid is obtained, and also by the application of the surplus heat from such furnace to the heating of air intended to be passed in a current over the sulphide of zinc, he effects a considerable improvement in this part of the manufacture. In treating the carbonate of zinc it is placed in a suitable vessel, and treated with sulphuric or muriatic acid, by which the carbonic acid is given off, and may be collected and applied to any purposes for which carbonic acid may be required. The sulphate or muriate of zinc formed by this process may also be collected and applied to any purpose for which those salts may be required. Into the flues of the retort furnace used in spelter making a stream of muriatic acid gas and a jet of steam are injected, by which means the oxide of zinc, or zinc fumes, passing through the said flues become converted into muriate of zinc, which may be condensed and collected at a point in the said flues where the temperature becomes sufficiently low for such condensation; or the vapours passing through the said flues are exposed in their passage to a shower of muriatic or any other acid, capable of dissolving the oxide of zinc, and the muriate or other zinc salt thus formed may be collected in a suitable reservoir. He claims as novel, the application of acids either in vapour or liquid to the fumes passing through the flues of the retort furnaces used in spelter making. The residue from the retorts, after the process of reduction has been practically completed, consists of about equal proportions of oxide of iron and oxide of zinc, and this being mixed up with a small quantity of clay or lime, or both, is submitted to the action of a blast in a small cupola or blast furnace, the vent of which is conducted into a cistern of water; by this means the iron will be reduced, and may be drawn off at the tap hole of the furnace, and the oxide of zinc will be carried forward into the cistern of water, where it will be deposited, and may be collected for use. What is novel in this part of the invention is the treatment of the residue from the retorts used in spelter making by means of a blast furnace in the manner described.

COAL-BURNING LOCOMOTIVES IN AMERICA.—"J. S. B." writing to the *United States Railroad and Mining Register*, and referring to the paper read at the Institution of Mechanical Engineers, says:—"A member of that body takes upon himself the credit of introducing an improvement in coal-burning engines, which was really introduced by Eastwick and Harrison, of New York. He says that previous attempts to burn Welsh steam coal had failed from the rapid burning of the grate bars; he overcomes this difficulty by covering the top of the grate bars with fire-brick. In the early engines of Eastwick and Harrison, intended for burning Pennsylvania anthracite, the same difficulty obtained, and by referring to the *Franklin Institute Journal* I find that as far back as 1839 Messrs. Eastwick and Harrison were in the practice of casting grate bars with a groove in their upper surface, which groove was filled with a thin layer of clay. It will thus be seen that this improvement was introduced by American mechanics nearly 20 years before the English. This gentleman says that the coal is worked with a small thickness of fire, which is the case with coal engines in the United States. In connection with this subject, a few words regarding American coal burners may not be amiss: the Baltimore and Ohio Railway Company, one of the most extensive corporations in the country, have been burning coal successfully in many of their engines since 1834. Six first-class passenger engines, from the designs of Mr. Henry Tyson, their master of machinery, were recently placed on the road, and are now running successfully burning coal. Of 28 engines employed in passenger service 14 are using mineral fuel, and there is *never* a deficiency in making steam. The six engines referred to have copper fire-boxes and iron tubes, tapering slightly towards the fire-box end, by which means the impurities contained in the water are drained into the water casing around the fire-box, and find their exit when the boiler is blown out. They do not otherwise differ materially from engines of modern construction. Passenger trains of five cars are drawn over the first division of the road, overcoming grades of 83 ft. per mile, with a consumption of 26 lbs. of coal per mile run, costing, including all transportation charges on the coal, 3·6 cents per mile run. No. 235 ran 37,176 miles during the past year, at an average cost of 3·32 cents per mile run. The coal burning freight engines of the company answer equally well. No. 230, a ten-wheel engine, burning coal, ran 23,900 miles during the past thirteen months, without failing in a single instance to make its trips in regular time, hauling at times 40 loaded cars. No. 229, built on the same plan, hauled 150 tons up the 17 mile grade, rising 116 ft. to the mile. No. 198, also a coal burning ten-wheel engine, takes the express train over the above grade at the rate of 20 miles an hour. It is but just to state that this road has the advantage of Cumberland coal, which is the most excellent fuel for steam purposes, although engines burning the same coal on the Philadelphia and Baltimore road (constructed on the plan of Mr. Dimpfel) do not appear to make steam well."

SUBSTITUTE FOR BLACKLEAD.—Mr. R. Hicks, Chatham-place, has patented an invention which consists in forming a composition of black schist, carburet of iron, combined with other substances (known in Devonshire and elsewhere by the name of shining or shiny ore), and plumbago of commerce, and with or without soda and lampblack; or in forming a composition of black schist and carburet of iron, with or without soda and lampblack. The following is the mode of proceeding:—Mix together eight parts of black schist, eight parts of the above-named carburet of iron, five parts of plumbago of commerce, one part of soda, and one part of lampblack; the whole of these ingredients having been reduced to a fine powder and sifted. When a composition is to be used in making crucibles, furnaces, and stoves, instead of blacklead, take eight parts of black schist, two parts of the said carburet of iron, and two parts of the plumbago of commerce—all in the state of powder—and mix them together, and proceed as if blacklead were being used in lieu of the composition, in the ordinary method of manufacturing such like commodities. When the composition is used in lieu of blacklead in making pencils, it is formed as follows:—Take two parts of black schist, two parts of the said carburet of iron, and eight parts of plumbago of commerce, all of which have been previously reduced to a fine powder, and mix them thoroughly together with a small quantity of water (say 1-14th part of water), and then put the mixture thus made into a strong metallic mould, and subject it to considerable pressure, by a hydraulic press, or otherwise. The composition, is thus consolidated into a block resembling a piece of solid metal; afterwards sawn into slabs of a proper size for making pencils, baked in a kiln or oven, heated gradually and sufficiently, and retained there long enough to harden to any degree required. This part of the process is well known to the manufacturers of blacklead for pencils. The patentee claims "the manufacture of a composition or compositions to be employed as blacklead, of the materials hereinbefore described, however, the same may be varied to suit the different purposes for which the composition is to be employed."

A SUBSTITUTE FOR RED LEAD has been patented for Messrs. Bouchard and Clavel, of Paris. The inventors, for this purpose, claim the application of ochreous earths in general; and, more particularly, of a species of red-ochre, very rich in silica and alumina, found in the departments of Yonne, France, and called Burgundy red, the composition of which is—Silica, 50·000 parts; oxide of iron, 14·50 parts; alumina, 26·60 parts; carbonate of lime, 7·60 parts; sulphate and phosphate of lime, magnesia, loss 1·30 parts=100·00. Cement prepared from this earth is alleged to be an advantageous substitute for read-lead in making joints of boilers, water and gas pipes, &c., by mixing with grease, oil, lime, and with fragments of unburnt earthenware, Roman cement, and chalk in about the following proportions:—Burgundy red, 66 parts; grease or oil, 15 parts; lime, 11 parts; unburnt earthenware, chalk, or Roman cement, 8=100. Diluted with volatile oil, this Burgundy red, or other analogous earth, serves as a coating for preserving metal to prevent oxidation.

THE LAW OF PARTNERSHIP.—Although it would be thought that in a country like England a knowledge of commercial law would be considered so indispensable that steps would be taken to ensure every schoolboy becoming acquainted with at least the outlines of it, it is regretable to find, even amongst men most interested, an almost total ignorance of the subject—a circumstance which leads many into difficulties. The law of Partnership may fairly be classed amongst the most important branches of commercial law, and, therefore, the little treatise just published (through Effingham Wilson) by Dr. J. W. Smith is likely to become a general companion for commercial men. It is of a similar character to Dr. Smith's "Handy Book on the Law of Bills, Cheques, and Notes," which has now reached its tenth edition, and doubtless the "Handy Book on the Law of Private Trading Partnership" will be equally successful.

ENGINEERING PRECEDENTS FOR STEAM MACHINERY.—Under this title a very valuable compilation by Mr. B. F. Isherwood, chief engineer of the United States Navy, has just been issued through Messrs. Baillière. It comprises accounts of the performances of steam-ships, and of experiments with propelling instruments, condensers, boilers, &c., accompanied by analyses of the same. The utility of the work will be at once apparent, as affording to many, perhaps, the only available means of arriving at a knowledge of what has already been practically accomplished, and how the best results have been obtained; so that there will be a good foundation for the engineer desirous of effecting improvments to work upon. We observe that the present is but one of a series to be published, and which, we trust, will meet with that reception works of such a nature so well deserve.

"THE PITMAN'S DAUGHTER; OR STRUGGLES FOR EDUCATION."—By the Rev. JOHN DODD, curate of Lumley, Durham.—Many philanthropic efforts have of late been made to ameliorate the uneducated condition of pitmen and their families, to effect which great difficulties present themselves, not the least being the indifference and apathy that parents themselves manifest upon the mental culture of their children. Although stern necessity in many cases doubtless compels parents to avail themselves of the earliest opportunity to reap a pecuniary benefit, how small soever that may be, from the services of their children, yet if parents could be taught that by educating their children both child and parent would receive inestimable benefits, much would thereby be done in effecting the end desired. The Rev. Mr. Dodd has written a tale with this excisive object in view, and which is of such an easy and simple diction, that it adapts itself at once to the most ordinary capacity, yet at the same time is so powerful in point, and so truly depicts the characters with which it has to deal, that its publication not only promises to do much good in the cause for which it was written, but, for general interest, is well worthy the perusal of all. In an interesting and lucid manner he shows that, while education is only an instrument, it is that by which mighty effects may be worked out; and although its possessors in every respect are superior to those who are uneducated, yet the author, so far as we can interpret the delineation of the characters he has pourtrayed, in no way espouses, but rather eschews, the practice of imparting to children a scholarship, which may and often does unsettle its recipients in the employment in which they are engaged. There is, however, if existing circumstances be any criterion, no reason, unhappily, to apprehend that this will at present be the case with our colliery population. Education has become a positive necessary in the efficient discharge of the duties of our everyday life, and now while it is within the grasp of the rich, not beyond the reach of the poor. It is a well-written tale, and the laudable object which actuated its author, in placing it within reach of the poorest, deserves the highest praise.

NEW AND EFFICIENT METHOD OF FEEDING BOILERS OF LOCOMOTIVE, MARINE, AND STATIONARY STEAM ENGINES, by which a GAIN of TWENTY-FIVE PER CENT. POWER is added to the engine, and a REDUCTION of FIFTY PER CENT. caused in the CONSUMPTION of FUEL.

1.—By it the steam is completely condensed to a vacuum from the piston, by which there is a gain of 15 lbs. per square inch on the piston of locomotive engines, and 11 lbs. on the square inch of marine and stationary engines over the present method of condensing steam.

2.—A less pressure of steam is required in the boiler to produce the same effect, and consequently less fuel is required.

3.—The boiler is fed with the hot water from the condensed steam, and by this means, also, there is a great saving of fuel. Steam is generated from the hot water of condensed steam with less fuel and in less time than from water.

4.—The water from the condensed steam being returned into the boiler, when the boiler has been once filled it requires a very small supply of fresh water for a number of hours, and the furring of the boiler is much less.

5.—A less weight of water and fuel is required to go double the distance.

6.—By the complete condensation of the steam, all that noise is avoided which has hitherto prevented the running of locomotive engines over common roads, and constitutes the greater part of the nuisance of railway engines being put on common roads.

7.—The waste of steam is so little, that steam vessels may take a sufficient quantity of fresh water with them to go to America, India, or Australia, and thus explain away the prejudicial effects of the salt water on the boilers, so that one boiler will last as long as four, besides the saving of the loss of time and expense in repairing and replacing boilers.

8.—By this method the feed pole and air pump bucket are rendered entirely useless, and the power employed to drive them is given to the engine, to do more needful duty.

9.—By this method, also, the explosion of boilers is rendered next to impossible.

10.—That with the 25 per cent. power being added to the engine, together with the reduction of 50 per cent. caused in the consumption of fuel, all railways will pay large dividends. The filtering beds in marine ships will also give place for general cargo and passengers, and the fact of the boilers being fed with fresh water is a sufficient reason to recommend its general adoption. The construction and simplicity of the apparatus is so inexpensive that it will cost a very small sum of money to be attached to any engine.

This invention is patented by Messrs. PASCOE and THOMAS, of Chacewater, Cornwall. 157

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GREAT BRITAIN and ROYAL CHARTER.
Appointed to Sail punctually from LIVERPOOL on the
5th and 15th of each Month.

The above, in addition to being the only line with steamers out of Liverpool, is composed of the LARGEST, FINEST, and FASTEST MERCHANT SHIPS in the WORLD.

Ship.	Register.	Burthen.	Captain.	Date.
BRITISH TRIDENT	1555	3500	O'NEILL	5th March.
MONTMORENCY	751	2500	STINSON	15th March.
DONALD M'KAY	2004	5000	TOBIN	To follow.

GREAT BRITAIN. | OCEAN CHIEF.
ROYAL CHARTER. | INDIAN QUEEN.
LIGHTNING. | BRITISH TRIDENT.
CHAMPION OF THE SEAS. | GIPSEY BRIDE.
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EX-ROYAL MAIL PACKETS.
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MERMAID	JAMES WHITE.	ARABIAN	M. GANDY.
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CYCLONE	GEORGE KERR.	SULTANA	BREWSTER.

And other celebrated clippers.

Ship.	Register.	Burthen.	Captain.	Date.
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TUDOR	1852	4500	WHEELAND	March 20.
RED JACKET	2460	5000	O'HALLORAN	April 1.
MERCHANT PRINCE	1745	4500	M'LAY	April 20.
MERMAID	1320	4000	JAMES WHITE	May 1.
WHITE STAR	2360	5000	KERR	May 20.

Passengers embark on the 18th and 31st March.

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12 Table Spoons, best quality	1 16 0	2 14 0	3 0 0	3 12 0
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12 Dessert Spoons, best quality	1 7 0	2 0 0	2 4 0	2 14 0
12 Tea Spoons, best quality	0 16 0	1 4 0	1 7 0	1 16 0
2 Sauce Ladles, best quality	0 8 0	0 10 0	0 11 0	0 13 0
1 Gravy Spoon, best quality	0 7 0	0 10 6	0 11 0	0 13 0
4 Salt Spoons (gilt bowls), best qu.	0 6 8	0 10 0	0 12 0	0 14 0
1 Mustard Spoon, best quality	0 1 8	0 2 6	0 3 0	0 3 6
1 Pair Sugar Tongs, best quality.	0 3 6	0 5 6	0 6 0	0 7 0
1 Pair Fish Carvers, best quality.	1 0 0	1 10 0	1 14 0	1 18 0
1 Butter Knife, best quality	0 3 0	0 5 0	0 6 0	0 7 0
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One Pair Extra Sized ditto	0 8 6	0 12 0	0 16 6
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